(12) UK Patent Application (19) GB (11) 2 252 195 (13) A

(43) Date of A publication 29.07.1992

(21) Application No 9125905.1

(22) Date of filing 05.12.1991

(30) Priority data
(31) 9019635 (32) 12.12.1990 (33) KR

(51) INT CL[5]
G11B 20/00, H04N 5/91

(52) UK CL (Edition K)
G5R RB402 RB721 RB789 RHX

(56) Documents cited
GB 2232292 A

(58) Field of search
UK CL (Edition K) G5R RHC RHX
INT CL[5] G11B, H04N
Online databases : WPI, INSPEC.

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(54) An apparatus for recording and reproducing caption signal used for a video tape recorder

(57) An apparatus for recording and reproducing a caption signal on and from an audio track of a video tape, used for a video tape recorder. The apparatus includes a microprocessor (10), a character buffer (20), a recording code converter (30), a linear audio recording/reproducing circuit (40), a mode selector (50), a reproducing code converter (60), a Hi-Fi audio recording/reproducing circuit (70), and an audio output controller (80), a video signal processor (90), and an on-screen-display circuit (100), whereby the caption character signal is recorded and reproduced by the audio head (41) on and from the audio track of the video tape.

FIG. 1

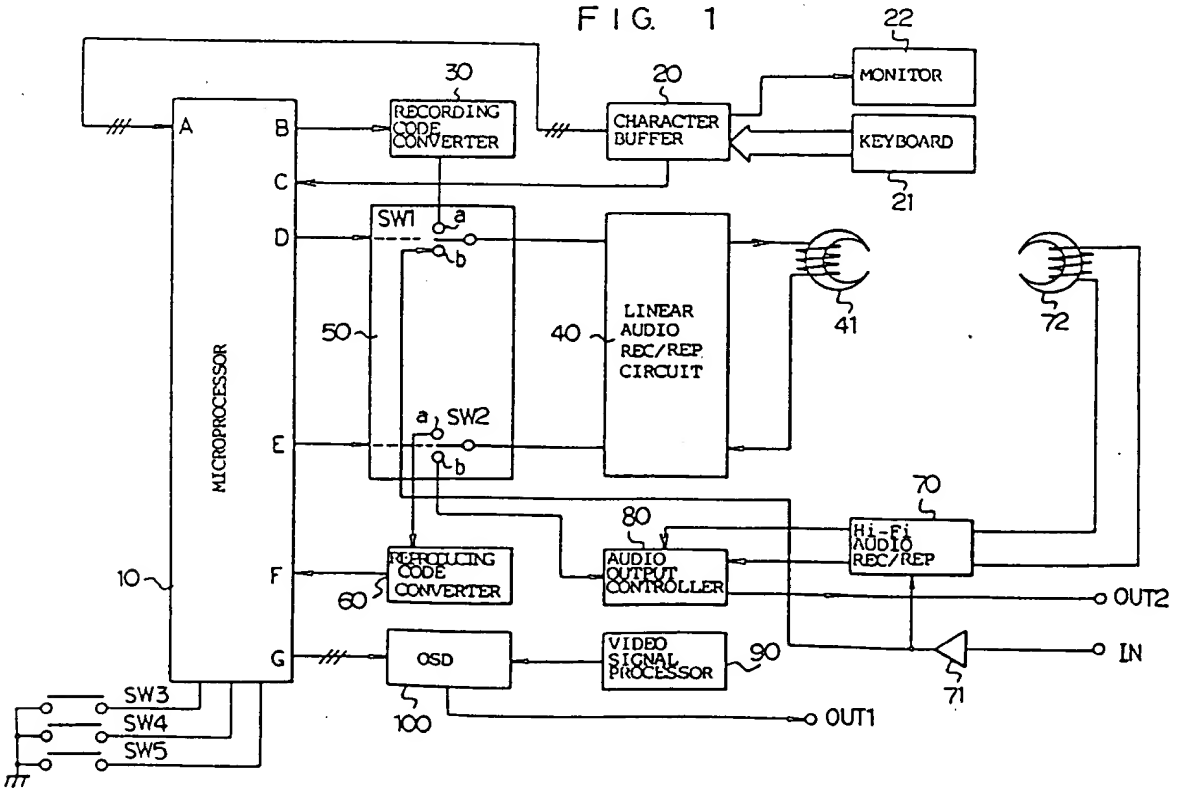


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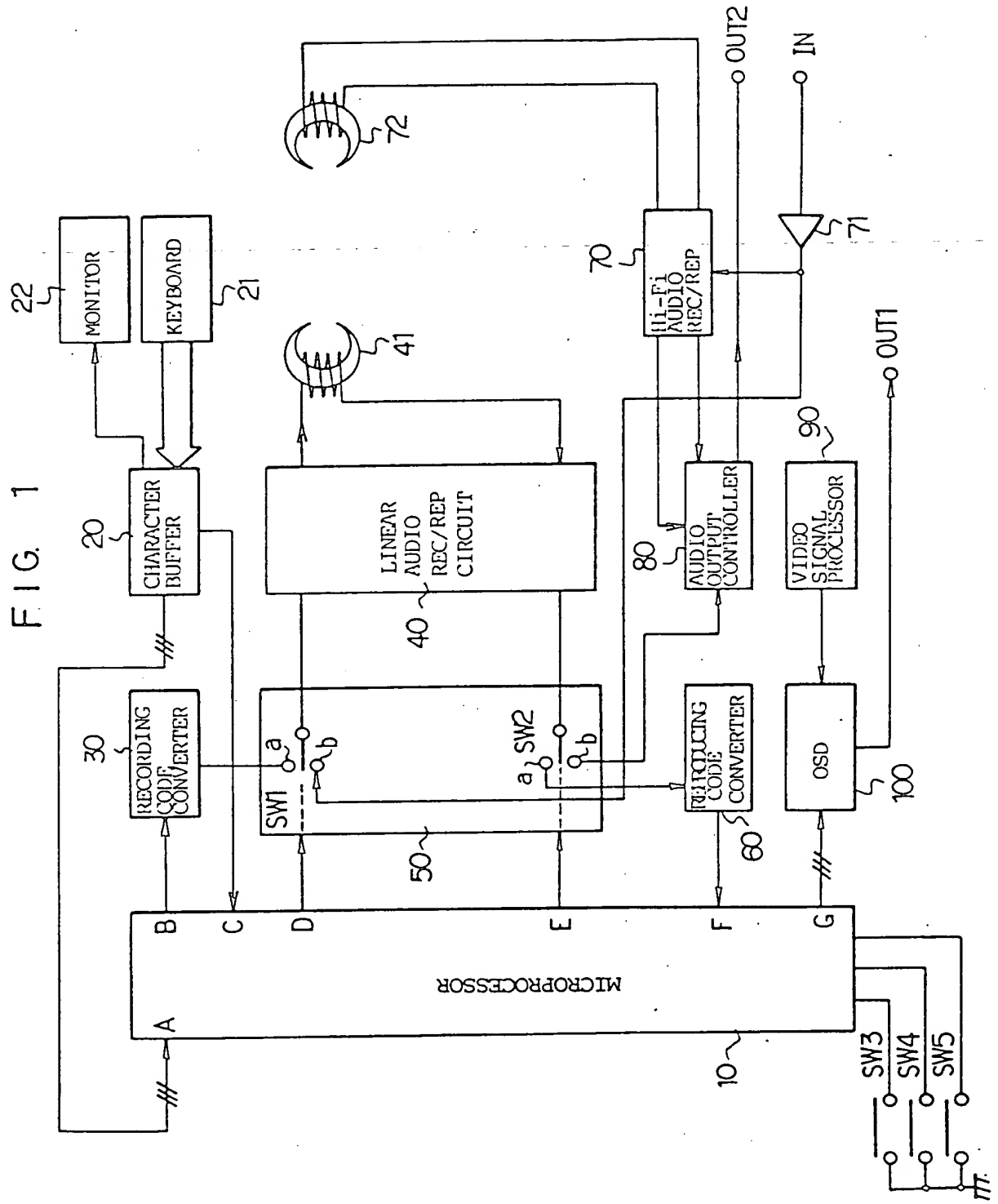
FIG. 1


MONITOR
KEYBOARD
CHARACTER BUFFER
RECORDING CODE CONVERTER
LINEAR AUDIO REC/REP CIRCUIT
SW1
SW2
REPRODUCING CODE CONVERTER
Hi-Fi AUDIO REC/REP
AUDIO OUTPUT CONTROLLER
VIDEO SIGNAL PROCESSOR
OSD
MICROPROCESSOR
OUT1
OUT2
IN
SW3
SW4
SW5
20
21
22
30
40
41
50
60
70
71
72
80
90
100
10
A
B
C
D
E
F
G

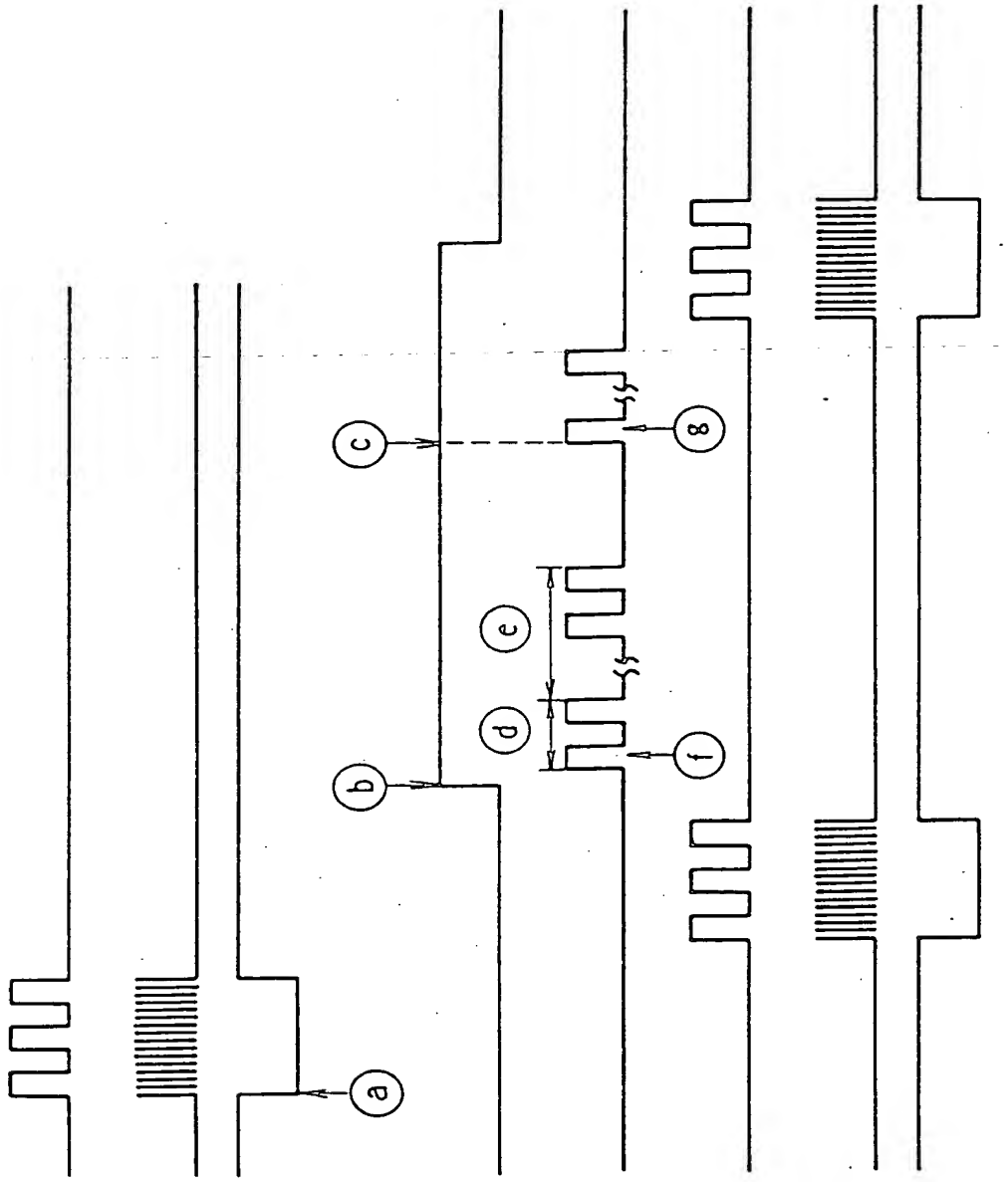



FIG. 2A

FIG. 2B

FIG. 2C

FIG. 2D

FIG. 3

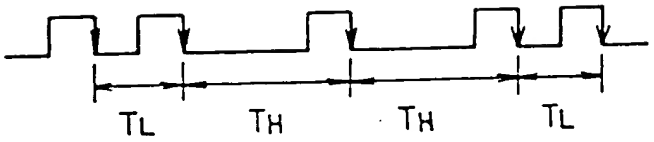

TL
TH
TH
TL

FIG. 4

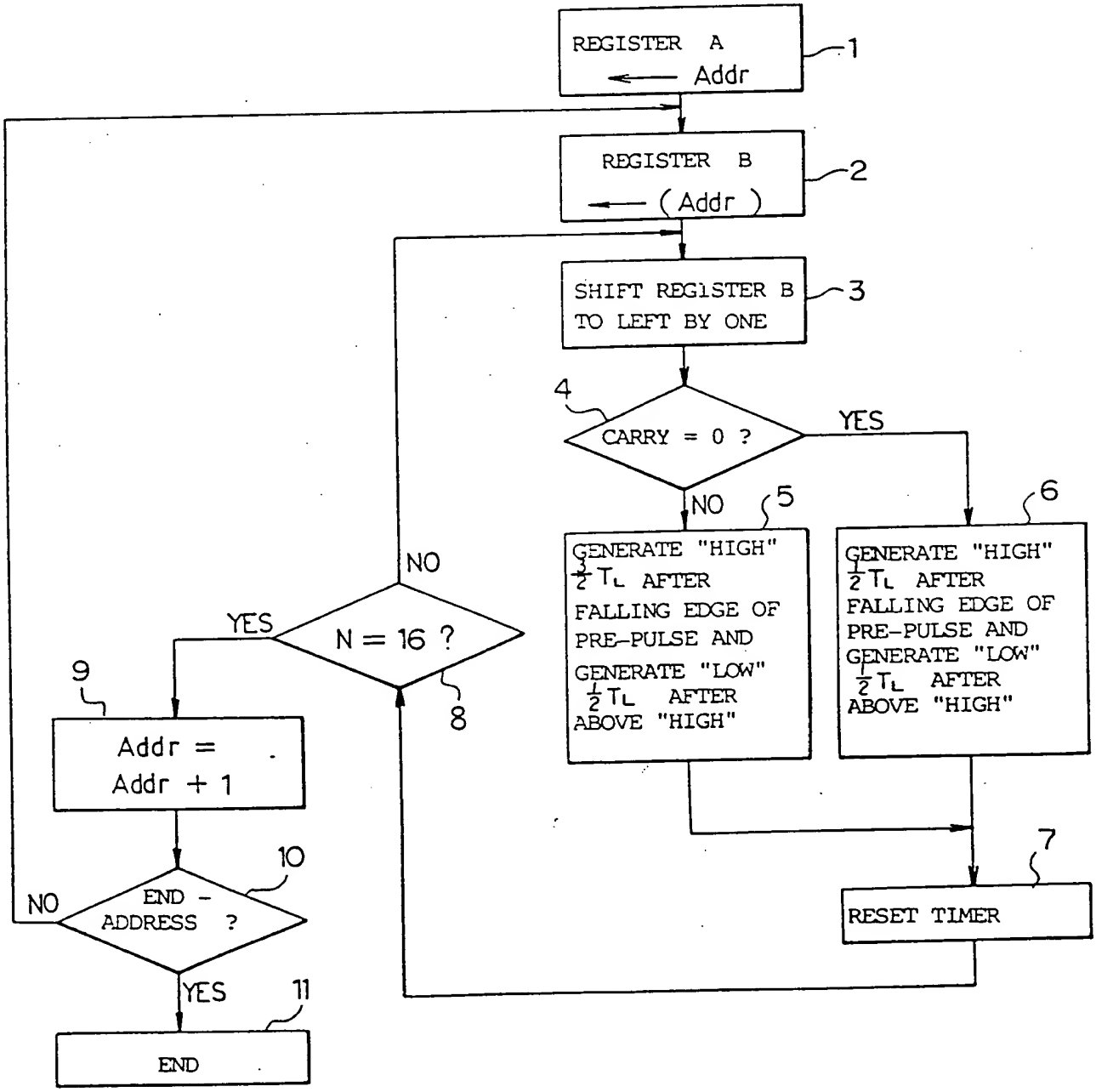

REGISTER A ← Addr
1
REGISTER B ← (Addr)
2
SHIFT REGISTER B TO LEFT BY ONE
3
4
CARRY = 0 ?
YES
NO
5
GENERATE "HIGH" 3/2 TL AFTER FALLING EDGE OF PRE-PULSE AND GENERATE "LOW" 1/2 TL AFTER ABOVE "HIGH"
6
GENERATE "HIGH" 1/2 TL AFTER FALLING EDGE OF PRE-PULSE AND GENERATE "LOW" 1/2 TL AFTER ABOVE "HIGH"
7
RESET TIMER
N = 16 ?
NO
YES
8
9
Addr = Addr + 1
10
END - ADDRESS ?
NO
YES
11
END

FIG. 5

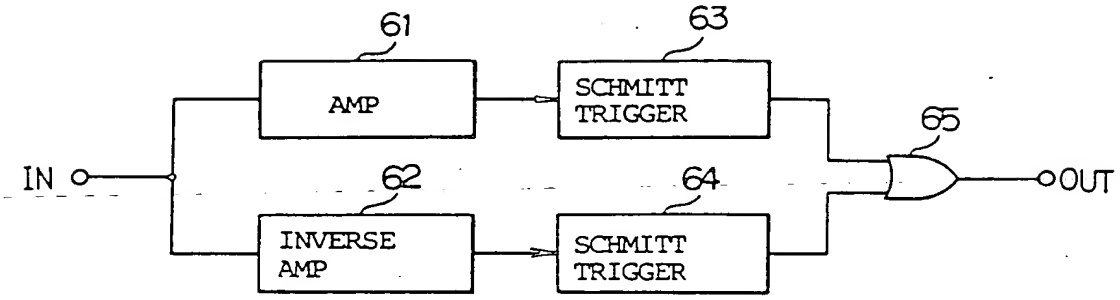



FIG. 6A

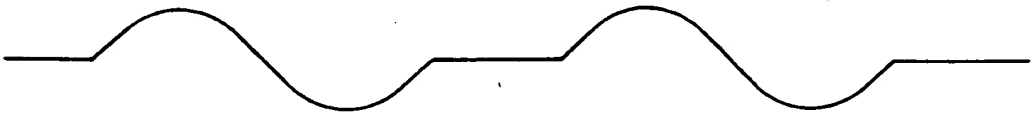


FIG. 6B

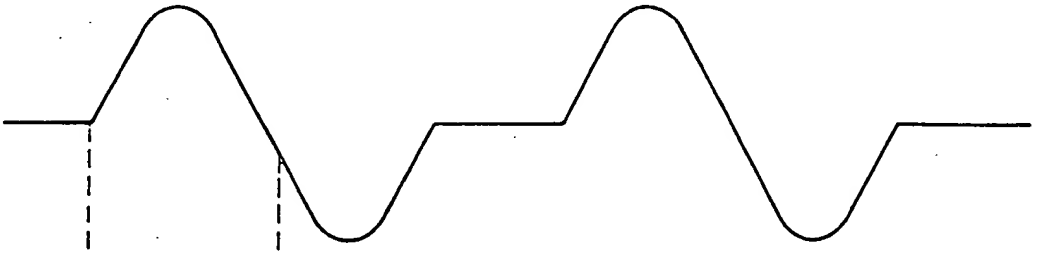


FIG. 6C

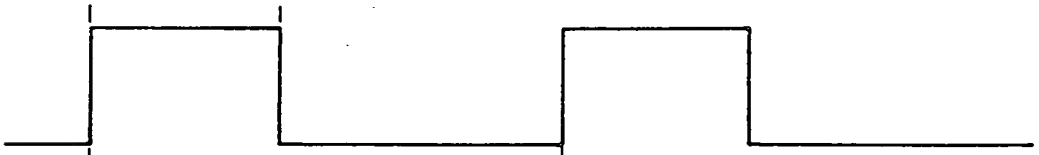


FIG. 6D

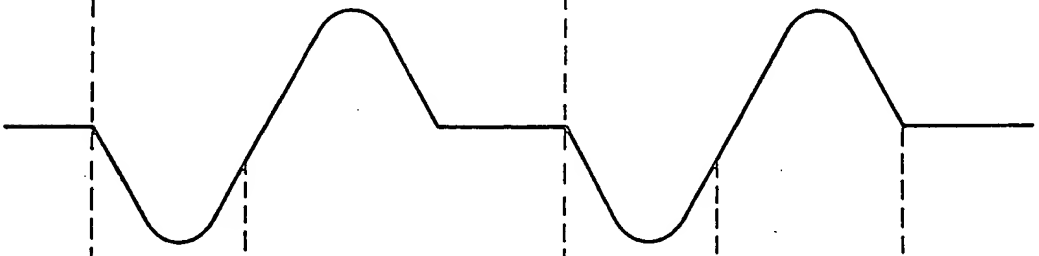


FIG. 6E

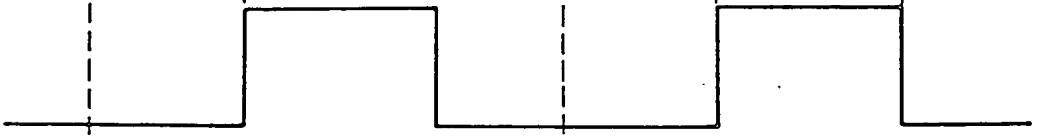
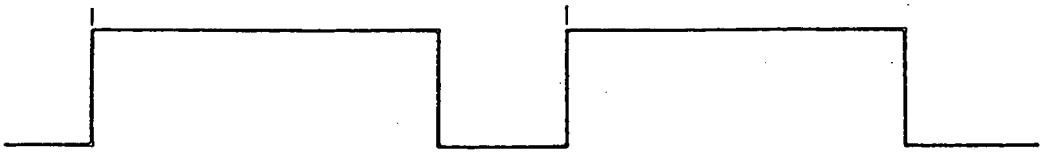


FIG. 6F



# AN APPARATUS FOR RECORDING AND REPRODUCING CAPTION SIGNAL USED FOR A VIDEO TAPE RECORDER

This invention relates to an apparatus for recording and reproducing caption signal and in particular, to an apparatus for recording and reproducing used for a video tape recorder (hereinafter, referred to as VTR) system, wherein the caption character signal (hereinafter, called a caption signal, for short) is recorded and reproduced on and from an audio track of the video cassette tape.

In a conventional VTR system, a video head included in an expensive caption editor was used for recording the caption signal on the video tape. If, however, the caption signal is recorded by the video head on the video track of the video tape, it is impossible to erase of the caption signal later on.

It is therefore an object of the present invention to provide an apparatus for recording and reproducing the caption signal on audio track of the video tape by means of an audio head in a video tape recorder, thereby allowing the apparatus to freely record and/or erase the caption signal when necessary.

A preferred embodiment of the present invention includes: a microprocessor for having a program for controlling caption character data; a character buffer (20) for memorizing character data received from a keyboard (21) and providing a monitor 22 with the character data memorized in response to a control signal from said microprocessor (10); a recording code converter (30) for converting the character data from said microprocessor (10) into an audio frequency signal; a linear audio recording/reproducing circuit (40) for recording a mono-audio signal on a video tape via a linear audio head (41) or processing the mono-audio signal received from the linear audio head (41); a mode selector (50) for selecting one of a caption recording or reproducing signals to be applied to and received from said linear audio recording/reproducing circuit (40), in response to a control signal from said microprocessor (10); a reproducing code converter (60) for converting into an original audio signal the caption reproducing signal in response to a control signal for the caption reproducing mode of operation from said microprocessor (10), to thereby sending said original audio signal to said microprocessor (10); a Hi-Fi audio recording/reproducing circuit (70) for recording on the tape a Hi-Fi audio signal from a buffer 71 via a Hi-Fi audio head (72)

or processing the Hi-Fi audio signal received from the Hi-Fi audio head; an output controller (80) for selecting one of the mono- and Hi-Fi audio signal output from said mode selector (50) and Hi-Fi audio recording/reproducing circuit (70); and a video signal processor (90) for processing video signal; an on-screen-display circuit (100) receiving said character data from the microprocessor (10), for generating a character display signal, said character display signal being mixed with the video signal.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Fig. 1 is a block diagram of an apparatus for recording and reproducing the caption signal according to the present invention;

Figs. 2A to 2D are timing diagrams of the apparatus of Fig. 1;

Fig. 3 is a pulse code signal which is communicated between a microprocessor (10) and a recording code converter (30) shown in Fig. 1;

Fig. 4 is a flow chart for showing the recording and reproducing procedure of the caption signal according to the present invention;

Fig. 5 is a detailed view of a reproducing code converter (60) shown in Fig. 1; and

Figs. 6A to 6F are waveforms at the respective parts of the reproducing code converter (60).

Referring to Fig. 1, an apparatus for recording and reproducing the caption signal in accordance with the present invention is illustrated. In the drawing, a microprocessor 10 including therein a program for recording/reproducing the caption character, analyzes the character data received in series from a character buffer 20 and converts it into a sequential pulse signal having a transmission speed of about 240 characters per second. The character buffer 20 memorizes the character data transmitted from a keyboard 21 and provides a monitor 22 with the memorized character data. A recording code converter 30 converts a character pulse signal produced from the microprocessor 10 into audio frequency signal. Furthermore, a leaner audio recording/reproducing circuit 40 is used for recording a mono-audio signal on the tape through a leaner audio head 41, or reproducing the recorded mono-audio signal through the linear audio head 41. Then, a mode selector 50 operates to select one of a caption recording and reproducing signals applied to and received from the linear audio recording/reproducing circuit 40, in response to a control signal from the microprocessor 10 for selecting the caption recording or reproducing modes of operation. A reproducing code converter 60 converts into original caption character signal the caption reproducing signal which is selected at the mode selector 50 according to the control signal

for the caption reproducing mode and then, the caption signal converted is applied to the microprocessor 10. A Hi-Fi (high-fidelity) audio recording/reproducing circuit 70 records on the tape the audio signal received from a buffer 71 by way of a Hi-Fi audio head 72, or reproduces the audio signal recorded on the tape by way of the Hi-Fi audio head 72. An audio output controller 80 processes the mono- or stereo-audio signals each received from the mode selector 50 or the Hi-Fi audio recording/reproducing circuit 70 respectively, the processed signals being produced through an output terminal OUT2. A video signal processor 90 processes the video signal and an on-screen-display (OSD) circuit 100 receives the caption data from the microprocessor 10 so as to produce therefrom a character display signal carried by the video signal from the video signal processor 90, through an output terminal OUT1.

Operation of the apparatus for recording/reproducing the caption signal in accordance with the present invention will now be described hereinbelow with reference to Figs. 1 and 2.

It is noted from Fig. 1 that the character buffer 20 temporarily memorizes the character data typed by the keyboard 21 serving as a character input device and transmits the character data to the monitor 22. In this way, when the caption character is displayed on the monitor, the user will determine a screen in still picture on which the caption character is to be written. At about this moment, if a character transmission switch SW3 is closed, the microprocessor 10 receives through a

character identifying input port "C" the logic high signal indicating that the character buffer 20 has received the character data.

If the logic high signal is applied to the character identifying input port "C" of the microprocessor 10, the microprocessor 10 receives through a serial transmission input port "A" character data DATA, clock signal CLOCK and chip selection signal $\overline{CS}$ , in series, as shown in Fig. 2A. Herein, it should be noted that a position "a" in the chip selection signal represents the time at which the character transmission switch SW3 is closed.

The microprocessor 10 delivers the serial data read from the character buffer 20 into the OSD circuit 100 in the form of the waveforms shown in Fig. 2D. Then, the OSD circuit 100 generates the character display signal carried by the video signal from the video signal processor 90, through the output terminal OUT1.

In the meanwhile, if a caption recording switch SW5 of a toggle switch for switching between the caption recording mode of operation and the caption recording release mode of operation is closed to put the microprocessor 10 into the caption recording mode of operation, the microprocessor 10 converts the character data received from the character buffer 20 into a pulse code signal as shown in Fig. 2C, and transmits the pulse code signal to the recording code converter 30. This pulse code signal is comprised of 16 pulse codes represented by one of the logic "0"

or "1", as shown in detail in Fig. 3.

Referring to Fig. 4, a flow chart is given for showing the program, performed by the microprocessor 10, of converting the character data received from the character buffer 20 into the pulse code signal. A head address of the memorized character data is stored into a register-A of the microprocessor 10 (Step 1), and the character data of the head address is stored into a register-B (Step 2). Then, the character data stored into the register-B is shifted to the left by one (Step 3) so as to check if a carry is generated (Step 4).

If a carry has been generated in the step 4, the logic high signal will be generated a period $(3/2)T_L$ after the falling edge of a pre-pulse of the character data and then, the logic low signal will be generated a period $(1/2)T_L$ after the above logic high signal generated (Step 5). If a carry has not been generated in the step 4, the logic high signal will be generated a period $(1/2)T_L$ after the falling edge of the pre-pulse of the character data and then, the logic low signal will be generated a period $(1/2)T_L$ after the above logic high signal generated (Step 6). During the steps 5 and 6, a timer for counting the time is reset (Step 7) and thereafter, whether the bit number N of the character data is identical to 16 is checked (Step 8). If the bit number is not identical to 16 in the step 8, the procedure returns to the step 3; however, if identical to 16, the address will increase by one (Step 9). Then, whether the address increased by one in the step 9 is identical to the end-address

of the character data is checked (Step 10). If the address is not identical to the end-address, the procedure returns to the step 2; otherwise, if identical to the end-address, the procedure will be ended (Step 11).

As can be appreciated from the foregoing, during the caption recording mode of operation, the pulse code signal transmitted from the microprocessor 10 to the recording code converter 30 will transmit an initial pulse code "f" of one word "d" as illustrated in Fig. 2 C, if the caption recording switch SW5 is closed. In a little while, if the caption recording mode of operation is released, a caption-end display pulse code "g" is generated by one word.

In the meantime, if a caption reproducing switch SW4 is closed to put the microprocessor 10 into the caption reproducing mode of operation, the microprocessor 10 encodes the character pulse input signal from the character buffer 20 to memorize encoded signal into a memory prepared therein. As regards the level determination of the encoded data stored in the memory, if $|\Delta T-T_L| \ll |\Delta T-T_H|$ after comparing $\Delta T$ with a reference signal for the caption recording where the $\Delta T$ is the time period from the falling edge of the pre-pulse transmitted from the microprocessor 10 to the falling edge of a pulse succeeding thereto, then $\Delta T \cong T_H$ so that the level is determined as "1"; otherwise, if $|\Delta T-T_L| \gg |\Delta T-T_H|$, then $\Delta T \cong T_L$ so that the level is determined as "0".

Based on the above determination rule, the microprocessor

10 receives a set of 16 pulse codes of the character data from the character buffer 20 so as to check each pulse code in turn if it is an initial pulse code. This checking is repeated until the initial pulse code is detected. If the microprocessor 10 has detected the initial pulse code, then each the following set of 16 pulse codes applied to the microprocessor 10 from this time forward will form a word and sequentially, 239 words will be stored into the memory of the microprocessor 10. Thereafter, the microprocessor 10 transmits this 239 word to the OSD circuit 100 via a serial port "G" whereby the OSD circuit 100 generates the character display signal. This character display signal from the OSD circuit 100 is carried by the video signal from the video signal processor 90 so as to be provided to the output terminal OUT1. At this moment, if the data value of one word applied to the microprocessor 10 is identical to the caption-end display value i.e., address-end (see Step 10 in Fig. 4), the caption display is terminated.

A signal applied to the recording code converter 30 through a character pulse generating port "B" of the microprocessor 10 is as represented in Fig. 3, and converted by the recording code converter 30 into an audio frequency band signal. On the other hands, the mode selector 50 switches on and/or off the switches SW1 and SW2 in response to the caption recording and reproducing modes of operation from the microprocessor 10. The following Table represents an exemplary view of the mode establishment according to the position of the switches SW1 and SW2, where the "x" represents the *don't care* condition.

TABLE

| | SW1 (switched) | SW2 (switched) |
|---|---|---|
| CAPTION REC. MODE | to "a" | x |
| CAPTION REP. MODE | x | to "a" |
| NORMAL REP. MODE | to "b" | to "b" |

Accordingly, during the caption recording, the signal produced from the recording code converter 30 is applied to the linear audio head 41 through the linear audio recording/reproducing circuit 40. Furthermore, during the caption reproducing, the signal output from the linear audio head 41 is processed at the linear audio recording/reproducing circuit 40 and then, applied to the reproducing code converter 60 through the switch SW2 of the mode selector 50. The reproducing code converter 60 converts the audio frequency band signal input into the rectangular pulse as shown in Fig. 3 to provide it to a character pulse input port "F" of the microprocessor 10.

With reference to Fig. 5, the reproducing code converter 60 is comprised of an amplifier 61 and an inverse amplifier 62 which receive in common the audio frequency band signal of Fig. 6A from the mode selector 50, via the input terminal IN. The amplifier 61 amplifies the audio frequency band signal into the waveforms as shown in Fig. 6B and the inverse amplifier 62 amplifies the audio frequency band signal into the waveforms as shown in Fig.

6D. The signal output from the amplifier 61 is schmitt-triggered by a first schmitt trigger circuit 63 and the signal output from the inverse amplifier 62 is schmitt-triggered by the second schmitt trigger circuit 64.

In this case, the first and second schmitt trigger circuits 63, 64 sets more than 0V for the rising edge input voltage and less than 0V for the falling edge input voltage, respectively. The signals triggered by the first and second schmitt triggers 63, 64 are produced as shown in Fig. 6C and 6D, respectively, and ORed by an OR gate 65 to generate the waveforms of Fig. 6F to the character pulse input port "F" of the microprocessor 10.

The output signal of the OR gate 65 is a signal reproduced from the caption character pulse signal during the recording mode of operation and decoded by the microprocessor 10 to be applied to the OSD circuit 100 in which the signal is converted into character display signal.

When the microprocessor 10 completes the receipt of the characters (i.e., 240x16 data-bits) for one frame from the reproducing code converter 60, it sends in series the OSD character display data to the OSD circuit 100. The OSD circuit 100 mixes the video signal from the video signal processor 90 with the character display data to provide the mixed signal to the output terminal OUT1.

On the other hands, however, if a control signal is not

supplied to the mode selector 50 from a caption reproducing port "E" of the microprocessor 10, the switch SW2 is switched to the position "b" so that the reproducing audio signal will now be applied to the audio output controller 80. The Hi-Fi audio head 72 reproduces the audio signal recorded on the tape, by means of the Hi-Fi audio head 72 and this reproduced audio signal is generated to the output terminal OUT2 via the audio output controller 80.

As appreciated from the above descriptions, the inventive apparatus is designed such that the caption character signal can be recorded or erased by use of the audio head included in a VTR system. Therefore, a user of this apparatus can freely and efficiently edit the caption characters into a video tape.

Although specific constructions and procedures of the invention have been illustrated and described herein, it is not intended that the invention be limited to the elements and constructions disclosed. One skilled in the art will easily recognize that the particular elements or subconstructions may be used without departing from the scope and spirit of the invention.

CLAIMS:

1. An apparatus for recording and reproducing a caption signal used for a video tape recorder, comprising:

a microprocessor having a program for controlling caption character data;

a character buffer for memorizing character data received from a keyboard and providing a monitor with the character data memorized in response to a control signal from said microprocessor ;

a recording code converter for converting the character data from said microprocessor into an audio frequency signal;

a linear audio recording/reproducing circuit for recording a mono-audio signal on a video tape via a linear audio head or processing the mono-audio signal received from the linear audio head ;

a mode selector for selecting one of a caption recording or reproducing signals to be applied to and received from said linear audio recording/reproducing circuit, in response to a control signal from said microprocessor ;

a reproducing code converter for converting into an original audio signal the caption reproducing signal in response to a control signal for the caption reproducing mode of operation from said microprocessor , to thereby sending said original audio signal to said microprocessor ;

a Hi-Fi audio recording/reproducing circuit for recording on the tape a Hi-Fi audio signal from a buffer via

a Hi-Fi audio head or processing the Hi-Fi audio signal received from the Hi-Fi audio head;

an output controller for selecting one of the mono- and Hi-Fi audio signal output from said mode selector and Hi-Fi audio recording/reproducing circuit ; and

a video signal processor for processing video signal;

an on-screen-display circuit receiving said character data from the microprocessor , for generating a character display signal, said character display signal being mixed with the video signal.

2. An apparatus for recording and reproducing a caption signal used for a video tape recorder, comprising:

a microprocessor having a program for controlling caption character data;

means for inputting character data to the microprocessor;

a recording code converter for converting the character data from said microprocessor into an audio frequency signal;

an audio recording/reproducing circuit for recording the audio frequency signal onto a video tape and for processing an audio frequency signal received from the video tape; and

means for displaying a character display signal derived from said audio frequency signal, said character display signal being mixed with a video signal.

3. An apparatus for recording and reproducing a caption signal for a video tape recorder substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

**Patents Act 1977**
**Examiner's report to the Comptroller under Section 17 (The Search Report)**

Application number
9125905.1

**Relevant Technical fields**

(i) UK Cl (Edition K ) G5R (RHC RHX)

(ii) Int Cl (Edition 5 ) G11B H04N

Search Examiner
A J RUDGE

**Databases** (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI, INSPEC

Date of Search
9 APRIL 1992

Documents considered relevant following a search in respect of claims ALL

| Category (see over) | Identity of document and relevant passages | Relevant to claim(s) |
|---|---|---|
| A | GB 2232292 A (SNYDER) see whole document | All |



HCS - c:\wp51\doc99\fil000157

| Category | Identity of document and relevant passages | Relevant to claim(s) |
|---|---|---|
| | | |

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